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10/729,756	12/05/2003	Shoupu Chen	87121SLP	3184

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EXAMINER	
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ART UNIT	PAPER NUMBER
2624	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/729,756	CHEN ET AL.	
	Examiner	Art Unit	
	ANTHONY MACKOWEY	2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 July 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,3-9 and 11-18* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,3-9 and 11-18* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 January 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments filed July 29, 2008 have been fully considered but they are not persuasive.

Applicant submits the prior art does not teach or suggest determining an accumulated rotation angle using image data because Uchiyama calculates the angle of rotations from magnetic field data.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.,* 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

The Wyman reference relied upon clearly discloses using only data obtained from the images to correct their orientation (col. 6, lines 61-64, col. 8, lines 23-37; col. 9, lines 43-49; col. 10, line 48 – col. 11, lines 3; col. 11, lines 41-58, *also see pages 4 and 5 of the previous Office Action*) and therefore disclosed or suggested using the image data to determine a rotation angle between arbitrary images. However, Wyman, while teaching the correction could be extended to bring any arbitrary number of images into alignment (col. 9, lines 1-6), limited the disclosure to describing alignment of two images. Therefore, Wyman did not disclose any further angle notation or calculation as it would pertain to correction additional images. Uchiyama was relied upon by the examiner as teaching an encapsulated endoscope system that captured a plurality of images having different rotational information and calculating the angle of rotation between them to place them in the same orientation. Uchiyama expressed the angles of rotation between

arbitrary images as an accumulated rotation angle (page 3, paragraphs 59-63). The combination articulated by the examiner was not to substitute the image correction taught by Wyman with that of Uchiyama (which requires the magnetic field data) but the that the rotation angles determined by Wyman between the reference image, orientation corrected images and arbitrary yet to be corrected images could be expressed as an accumulated rotation angle as taught by Uchiyama. The extent to which Uchiyama's disclosure of accumulated rotation angle was relied upon was not to teach that of using the magnetic field data to determine rotation angle, but merely the way of expressing the relationships of the angles between the images. The combination of Wyman and Uchiyama as suggested by the examiner would predictably result in using the techniques of Wyman to align endoscope images and expressing the angles of rotation between the images as accumulated rotation angles as taught by Uchiyama.

With regard to applicant's argument to the recitation of "where the second arbitrary image and the reference image need not have a spatially overlapping area," again, this language does not explicitly preclude the images from having spatially overlapping regions. The language is suggestive that they aren't required to have overlapping regions. The language does not insist that the images not have spatial overlap, nor does it define in what dimension of space, and to what relative space, they need not have spatial overlap. Could they overlap in one spatial dimension and not in another? Can they overlap in any spatial dimension, or none? Furthermore, the technique for determining a rotation angle between images disclosed in applicant's specification is that of point pair searching and matching (pages 10-13). The orientation correction of images not having any spatial overlap (which are never explicitly referred to as such) is obtained through the accumulated rotation angle. That is, intermediate adjacent images

have some amount of spatial overlap with the reference image and the arbitrary second image, their orientation correction and rotation angles are used to determine the angle between the reference and the arbitrary second image (page 13, Fig. 5). If the method of Wyman were extended to align more than two images such as the endoscope images taught by Uchiyama and utilized the calculation and expression of accumulated rotation angle as taught by Uchiyama, the combination of their teachings clearly discloses or suggests all requirements and language of the claims, including the "need not spatially overlapping" suggestion.

Therefore, the combination of Wyman and Uchiyama is not deficient in its disclosure or suggestion of all the limitations of the presently claimed invention and the rejections under 35 U.S.C. 103 are maintained.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3-9 and 11-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wyman in view of US 2003/0229268 to Uchiyama et al. (Uchiyama).

Regarding claims 1 and 17, Wyman discloses a digital image processing method for automatic axial rotation correction of a sequence of in vivo images in a same set using image data (col. 6, lines 34-37; col. 7, lines 30-64; col. 1, lines 53-65), comprising the steps of:

a) selecting, as a reference image, a first arbitrary in vivo image from the sequence of in vivo images (col. 6, lines 40-45);

b) using the image data to determine a rotation angle between a second arbitrary in vivo image selected from the sequence of in vivo images and the reference image of the sequence (col. 6, lines 57-61; col. 8, lines 23-37; col. 9, lines 43-49; col. 10, line 48 - col. 11, line 3; col. 11, lines 41-58, *Wyman teaches applying affine transformations including rotating the images in the image registration. the determination of an angle of a rotation angle between the reference image and the second image is inherent to the rotation transformation of registration method taught by Wyman.*);

c) correcting the orientation of the second arbitrary in vivo image, with respect to orientation of the reference image and corresponding to the rotation angle determined with the image data (col. 6, lines 61-64; col. 8, lines 23-37; col. 9, lines 43-49; col. 10, line 48 - col. 11, line 3; col. 11, lines 41-58).

Wyman further discloses using orientation corrected images, obtained using the image data, to determine a rotation angle between other selected in vivo images and the reference image (col. 6, lines 57 – col. 7, line 3; col. 8, lines 23-37; col. 9, lines 43-49; col. 10, line 48 - col. 11, line 3; col. 11, lines 41-58; col. 9, lines 1-6, col. 15, lines 6-22, *Wyman teaches applying affine transformations including rotating the images in the image registration thereby bringing an arbitrary number of images, into alignment. Wyman further teaches the transformations may be applied to a subset, convergence is determined and the steps are repeated, thus the transformed subset (orientation corrected images) is used to perform registration of the rest of the set (other in vivo images). the determination angle of a rotation angle between the reference image and the*

second image is inherent to the rotation transformation of registration method taught by Wyman.); and correcting for the other selected in vivo images that do not match the reference image's orientation and where there exists a rotation angle between the other selected in vivo images and the reference image (col. 6, lines 61-64; col. 8, lines 23-37; col. 9, lines 43-49; col. 10, line 48 - col. 11, line 3; col. 11, lines 41-58; col. 9, lines 1-6, *Wyman teaches the process may be extended to bring an arbitrary number of images or image sets into alignment.*). Wyman further discloses the disclosed technique can be used for registering any 2D or 3D images (col. 7, lines 61-64)

While Wyman discloses bringing any arbitrary number of images into alignment, the explicit details of the alignment are limited to a discussion of only two images. Therefore, Wyman is silent with regard to an accumulated rotation angle which is used to correct other selected in vivo images and the reference image. Uchiyama discloses using angles of orientation corrected images to determine an accumulated rotation angle between other selected in vivo images in a sequence and a reference image from a sequence of in vivo images captured by an encapsulated endoscope and correcting for the other selected in vivo images that do not match the reference image's orientation using the accumulated rotation angle where there exists a rotation angle between the other selected in vivo images and the reference image, where an arbitrary second image need not have spatially overlapping area with the reference image (Figs. 5 and 6; pages 3-4, paragraphs 58-73).

Wyman and Uchiyama are combinable because they are both concerned with medical image processing, specifically rotating the medical images to properly align them for display. It would have been obvious to one of ordinary skill in the art at the time the invention was made to

combine the techniques taught by Wyman and Uchiyama such that the image registration techniques taught by Wyman could apply to images captured by an encapsulated endoscope system such as the one taught by Uchiyama (and the present invention) and that the method of Wyman could be modified to include using the orientation corrected images to determine an accumulated rotation angle between other selected in vivo images the sequence and a reference image from a sequence of in vivo images captured by an encapsulated endoscope and correcting for the other selected in vivo images that do not match the reference image's orientation using the accumulated rotation angle where there exists a rotation angle between the other selected in vivo images and the reference image, as taught by Uchiyama, in order to bring any arbitrary number images into alignment with the reference image.

Regarding the limitation "where the second arbitrary image and the reference image need not have a spatially overlapping area" as recited in claim 17, the language of the claim does not explicitly preclude the images from a having spatially overlapping area, just that they don't necessarily have to. Thus the images disclosed by Wyman meet the requirements of the claim. Further Uchiyama's images are a sequence of image captured by the encapsulated endoscope and are aligned based on the accumulated rotation angle and therefore, the first image would not need not to be spatially overlapping with an arbitrary other image in the sequence.

As to claim 18, while having different language from that of the method recited in claim 17 and not claiming the selection of a reference image, limitations analogous to those of claim 18 have been addressed in the in the rejection of claims 1 and 17 above. Therefore, arguments

analogous to those presented above for claims 1 and 17 are applicable to claim 18, the "reference image" of claims 1 and 17 corresponding to the "first image" recited in claim 18.

Regarding claim 3, the combination of Wyman and Uchiyama further discloses the step of correcting the orientation of the arbitrary in vivo image, with respect to orientation of the reference image and corresponding to the rotation angle uses an accumulated correction angle derived from the accumulated rotation angle (Wyman, Fig. 5; col. 8, line 60 – col. 9, line 6; col. 10, line 48 – col. 11, line 3; Uchiyama, Figs. 5 and 6; pages 3-4, paragraphs 58-73).

Regarding claim 4, the combination of Wyman and Uchiyama further discloses the rotation angle measured with respect to an optical axis of an in vivo camera used to capture the plurality of in vivo images, and wherein the optical axis is perpendicular to an image plane and is parallel to the in vivo camera's travel trajectory derivative (Uchiyama, Figs, 3, 9, 10, 12, 13, 14, 15, 16; paragraphs 6, 42, 55-58).

Regarding claims 5 and 6, the combination of Wyman and Uchiyama further discloses the rotation angle is defined in a right-hand system or a left-hand system and angle is rotated counter-clock wise or clockwise relative to the reference image's orientation, such that the rotation angle is a signed value (Wyman, Fig. 8; Fig. 9E; col. 8, lines 1- 37; col. 11, line 41 – col. 12, line 4; col. 14, lines 60-62).

Regarding claim 7, the combination of Wyman and Uchiyama further discloses the plurality of in vivo images have a plurality of feature points, and wherein the plurality of feature points are used for finding an orientation difference between two in vivo images (Wyman, col. 6, lines 46-64).

Regarding claim 8, Wyman discloses an origin of a two-dimensional coordinate system of the in vivo images, thus defining an image plane, is at an image's center (Fig. 5; col. 10, lines 48 – col. 11, line 3, Wyman clearly shows two-dimensional images oriented in an X-Y coordinate system, with Z coordinate identifying each image's two-dimensional plane location in the stack of images, with an origin at the intersection of the intersection of axes. It is clear if the image sets are limited to a single image (as suggested by Wyman at column 8, lines 63-65), the coordinate system would be limited to a two-dimensional system as there is no "stack" of images"), and further comprising the steps of:

a) collecting the plurality of feature points that reside on a first image plane (Fig. 5; col. 6, lines 46-54; col. 10, line 48 – col. 11, line 3, Wyman selects points at the corners of the images);

b) finding a corresponding plurality of feature points in a second image plane (col. 6, lines 46-54; col. 10, lines; col. 10, line 48 – col. 11, line 3);

c) determining whether a feature point that resides on the first image plane moves in the second image plane (col. 6, lines 54-57); and

d) measuring the feature point's movement in the second image plane to determine the rotation angle and its direction (col. 6, lines 57-64; col. 10, line 48 – col. 11, line 3).

The combination of Wyman and Uchiyama does not disclose expressly collecting the plurality of feature points that reside on the axis of a first image plane; determining whether the feature point that resides on the axis of the first image plane moves off axis in the second image plane; and measuring the feature points movement off axis in the second image plane to determine the rotation angle and its direction.

At the time of the invention, it would have been obvious to a person of ordinary skill in the art to modify the feature points taught by Wyman to include points that reside on the axis of the image plane. Applicant has not disclosed that collecting feature a plurality of feature points that reside on an axis of an image plane provides an advantage, is used for a particular purpose or solves a stated problem. One of ordinary skill in the art, furthermore, would have expected Applicant's invention to perform equally well with points not on the axis because applicant's specification recites "people skilled in the art can easily extend this analysis to points that are not on the axis" (page 13, lines 3-4).

Therefore, it would have been obvious to one of ordinary skill in this art to modify the combination of Wyman and Uchiyama to include collecting a plurality of feature points that reside on an axis of a first image plane to obtain the invention as specified in claim 8.

Regarding claims 9, 11-16, the combination of Wyman and Uchiyama further discloses a computer storage medium having instructions stored therein for causing a computer to perform a method (Wyman, col. 11, lines 18-39).

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ANTHONY MACKOWEY whose telephone number is (571)272-7425. The examiner can normally be reached on M-F 9:00-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Bella can be reached on (571) 272-7778. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Matthew C Bella/
Supervisory Patent Examiner, Art Unit 2624

AM
10/5/08